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AUTHOR Klein, Robert P.
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ABSTRACT

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## Abstract

# MULTIVARIATE COMPARISON OF TWO MODEL PRESCHOOL PROGRAMS

Robert P. Klein, Ph.D.

Social and Behavioral Sciences Branch
National Institute of Child Health and
Human Development

The classroom experiences of children in two model preschool programs were compared using an observational technique which was developed for a study of Head Start classrooms. The main objective of the study was to determine if the observation scale could discriminate between two programs of widely differing philosophy. The second goal of the study was to determine the number of independent dimensions which differentiated the two programs. Univariate analyses of variance showed that the programs differed on a number of variables. In order to determine if these variables were all measuring the same dimension, multivariate analyses were used. The results of these analyses indicated that more than one dimension was required to properly describe the classrooms but that the precise nature of the dimensions depended on whether one was interested in differences between the programs or variations within a program.

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# MULTIVARIATE COMPARISON OF TWO MODEL PRESCHOOL PROGRAMS *

Robert P. Klein, Ph.D.

Social and Behavioral Sciences Branch
National Institute of Child Health
and Human Development

Bethesda, Maryland 20014

* Paper to be presented at the August 1973 convention of
The International Society for the Study of Behavioral Development

Although there has been much theorizing during the past half century and particularly during the last decade about what sorts of environments lead to optimal development, we are only beginning to develop the measures and the techniques which will allow us to assess the impact of different environments. In the field of preschool education several different models have been developed based on widely different views of the process of development. Basic to understanding the effects of these approaches on children is knowledge of children's experiences in programs based on their philosophies. As part of a study on the experiences of children in Head Start, our group at the National Institutes of Health developed a scheme for recording the events in preschool classrooms.

The results of that study showed few significant relations between our measure of classroom events and gains in various areas of functioning. A possible explanation for this lack of results was that our observation scheme lacked validity. Therefore we decided to carry out a small scale study which would give us some information about the scale's validity. Our approach was to see if the scale could discriminate in meaningful ways between preschool programs of differing orientations. We felt that if the categories of the scale could discriminate among different programs this would be at least some indication of its validity. For the present study we observed only two programs. We realize that a full test of the scale's differentiating pow[illegible]ld

require far more than two programs, but we considered this study only a first step. The two programs were Bank Street and Montessori. A major problem in the study was to observe in schools that were good representatives of their respective models. For Montessori we did this by consulting with the Montessori Institute of Washington, D.C. about good Montessori programs in the area. For Bank Street we decided to make our observations in classrooms run by the Bank Street College of Education. Three classrooms were observed in each program. In each classroom observations were done on four boys and four girls, giving a sample of 24 children for each program.

Details of the observation method have been given in a previous paper and will not be repeated here. One point that does bear repetition, however, is that in our scheme the focus of observation is an individual child and not the teacher, the classroom as a whole or groups of children. Observations are coded in terms of some 120 categories that describe specific behaviors. For purposes of analysis specific combinations of categories are used to construct more theoretically meaningful variables. A considerable amount of staff time was spent in reading the literature of the two programs to derive variables that would adequately describe the ideal events which should occur under one or the other approach. These variables were composed of one or more of the 120 basic categories. Of course these were the categories which were originally used in the Head Start study. Giving the

derivations in any detail would use up far more time than is allotted for this paper. Instead I shall give brief descriptions of the two programs and when giving the results try to describe the variables in terms that relate to the capsule summaries.

Although these descriptions will emphasize the differences between the two programs, it is important to realize that they are also similar in many ways. For example, they share many of the same goals. Both programs aim to develop a child's independence, respect for others, task persistence and ability to order and organize his experiences. Where the programs differ is in the means they use to achieve these ends.

The Bank Street approach has as its ultimate objective to enable each child to become deeply involved and self directed in his learning. Activities are planned for both individual and groups of children. The classroom is the child's work room where he is free to investigate objects and explore media. Concrete, sensory and motor activities are interrelated with opportunities for functional and expressive use of language. The teacher is regarded as highly important in the program. She not only functions as a consistent adult whom the child learns to trust, but she also sensitizes the youngster to his experiences, to sights, sounds, feelings and ideas.

The goals of the Montessori program fall into four general categories: (1) development of ability to arrange objects in order according to their sensory properties

(2) conceptual development (3) competence in daily activities and (4) development of independence, self-discipline, persistence and love of learning. Each activity provided in the class is carefully programmed in a sequence of small steps. It is the teacher's major responsibility to instruct the children in the appropriate sequence for each activity. The child's spontaneous repetitions of these activities instruct and reinforce him, making the teacher's role of reinforcement and conduct modification minimal. Since there is very little or no formal grouping in the Montessori class and since the class contains children with a mixture of ages, there is a great deal of peer interaction both of a social and instructive nature.

An important theme running through both these descriptions is the concept of structure. We have distinguished two meanings of this concept. The first concerns the organization of the class day. Who decides what the children will do next -- the teacher or the children themselves? Both the Bank Street and Montessori approaches feel that children should be given the freedom to choose the activity they will work on at a particular time from those that are available in the class. Thus we expect both programs to have a high frequency of free choice time. On the other hand, the nature of the activities made available differs greatly between the two programs. Bank Street tends to provide activities, e.g. building with blocks, which allow for a wide variety of responses. The responses appropriate for any particular activity

in Montessori are prescribed either by the materials themselves or by the teacher's instructions. So even though the program would not be expected to differ on the structure of the class day, we did expect them to differ on the structure of the individual activities.

## Results

Plan of Analysis. On the basis of the literature describing the two programs, three sets of variables were formed from the basic categories. These variables involved only those categories dealing with the child's activities, and not with categories describing what the teacher or aides were doing. The variables in the first set measured activities and experiences thought to be important by Montessori but either were deemphasized or not mentioned in the Bank Street literature. The variables in the second set attempted to measure the experiences emphasized by Bank Street and not by Montessori. Finally, the variables in the third set measured experiences emphasized by both programs, e.g. freedom to choose activities. We did not expect to find differences between the two programs on the variables in the last set and indeed we found none so they will not be considered further in this report. Table I lists the variables from the first two sets which discriminated between the two programs at the $p < .01$ level, together with their F ratios. Indeed there were only a few variables which did not reach the $\alpha = .01$ level. But what do all these differences amount to? Perhaps they only reflect a single basic difference between the two programs, e.g. degree of structure of activities, which were

discussed earlier. It is this issue which I would like to focus on for the next few minutes. Basically I shall argue that there are both statistical and conceptual reasons for concluding that these differences are not due solely to a difference in single dimension. The statistical discussion will also serve to illustrate how multivariate techniques can add to the interpretation of multiple univariate tests.

First the statistical argument. One indication of the independence among the variables is the size of their inter-correlations within each program. These are given in Table 2. The correlations above the diagonal are for the Bank Street children, and those below the diagonal for the Montessori children. You will notice two rather high correlations. These are due to the fact that the variables involved have overlapping definitions. Therefore one member of each pair was eliminated from further analyses, the one with the more restrictive definition. Although several of the remaining correlations are significant, none of them are so high as to suggest that two variables are measuring essentially the same thing. I shall leave hanging for a few moments how many factors underly these correlation matrices.

The next step in the analyses was to determine whether any of the between program differences were actually due to between teacher differences within program. For completeness, sex of child was also included in the analyses.

Thus the three factors were program, teacher (nested under program) and sex. Table 3 gives the results of these analyses. The main

point of this table is that of the twelve variables in the analyses three no longer showed a significant program effect. Those are the ones with an X beside them.

This left nine variables, which are listed in Table 4. Four of the variables are from the Montessori set and five from the Bank Street set. Two multivariate analyses of variance were run, i.e. one for each set of variables. Before discussing them I will briefly describe the variables used in the two analyses. The first Montessori variable, Structured Activities, was discussed earlier. These are activities whose responses are prescribed either by the materials or by teacher instruction. The next three variables, Manipulation, Sensorial and Didact, form a sort of heirarchy. Manipulation describes activities which focused on teaching the child a sequence of movements or actions, e.g. table washing. In general, as in the case of table washing, these activities also taught the child how to care for the equipment in the classroom. Sensorial activities dealt with ordering objects along some dimension, e.g. size or number. Thus the concept of sequence is extended from movements to sensory experience. Finally, Didactic Activities deal with symbols, e.g. letters, words and numbers.

The first Bank Street variable, Unstructured Activities, has also been discussed previously. These are activities with many response possibilities. Social Communication are those interactions with peers that do not concern a specific task or activity which the

child is working on at the moment. This category seemed to include units in which the child was merely wandering around the classroom. Exploration of materials includes activities which focus on investigating the properties of objects. Expressive behavior includes signs of affect, whether positive or negative, as well as whole body movement such as running or jumping. The last variable, Fantasy, includes any activity in which the child pretends that he or an object he is playing with is something else.

The aim of the multivariate analyses was to determine how many variables in each set differentiated independently of the others between the two programs. Two statistics were used for this purpose. One was the Step Down F described by Bock ( 1966 ). The other was the standardized discriminant coefficient of each variable. For the Step Down F it is necessary to specify the order of the variables for making the comparison. The F test of each of the variables uses the preceding variables as covariates. Thus each step down F is independent of the one before it. For each set of variables the order was determined by first testing the most general variable, which is the activity structure variable, and then testing the remaining variables in order of their increasing univariate F's. (The design included only the program factor.) Table 4 gives the order of the variables for each of the two analyses. It also gives the Step Down F's and their associated p values. The results show that for the Montessori

variables once Structured Activity is included none of the other variables are significant at the 1% level. On the other hand, for Bank Street two variables in addition to unstructured activity significantly differentiate between the two programs. They are Social Communication and Fantasy. The Standardized Discriminant coefficients tell a similar story.

Finally I would like to discuss the question I left hanging a few moments ago: how many independent dimensions underly the variables which we measured. For this purpose two factor analyses were run, corresponding to the two multivariate ANOVAS. One factor analysis was of the five Bank Street variables using just the 24 Bank Street subjects. The second factor analysis was of the four Montessori variables using only the Montessori subjects. Two factors with eigen values greater than 1 emerged from each analysis. Table 5 summarizes the two analyses. For Bank Street the first factor had high loadings (above .50) for Unstructured Activities, Social Communication and Fantasy; the second factor had a high loading for Exploration. The three variables loading highly on the first factor are precisely the three which discriminated independently between the programs. The first factor for the Montessori variables had high loadings for Structured Activity and Manipulation. The second factor had a high loading only for Didactic activities.

While statistical techniques can sometimes be quite useful in determining the number of dimensions needed to describe preschool environments, due regard should be given to conceptual considerations.

For example, sensory experiences can occur either as part of a structured or an unstructured activity. So the fact that sensory experiences and structured activity may be fairly highly correlated in one program does not necessarily imply these are merely two ways of measuring the same thing. Furthermore the variables which discriminate between Bank Street and Montessori are probably not the ones which would discriminate among some other pair of programs. What seems to be the most heuristic approach is to have an observation scheme with categories which describe preschool environments in considerable detail. These categories may then be combined in broader variables as we have done in this study. Considerable future research will be necessary to determine if the variables which may seem to be conceptually independent nevertheless are always found to covary, no matter what the program.

To sum up, multivariate analyses of these data indicated that the programs differed from each other in more than one respect and that activities within them need to be described in terms of more than one dimension. However, the two analyses gave a different picture of the structure underlying our variables. In determining the dimensions needed to describe preschool programs, it is important to distinguish questions concerning differences between programs from interrelations among the variables within a program. This suggests that it is very unlikely that statistical techniques can be used to determine a set of dimensions in terms of which all programs can be described.

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